



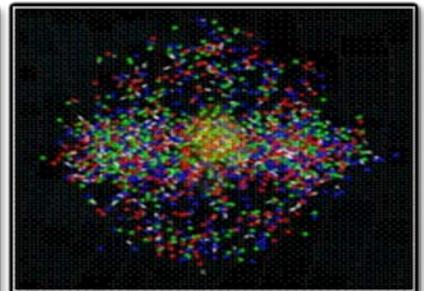
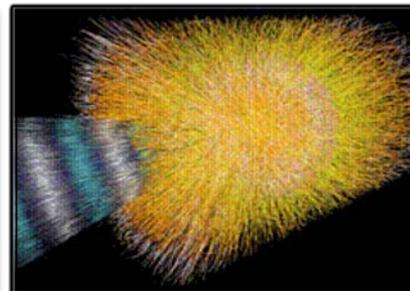
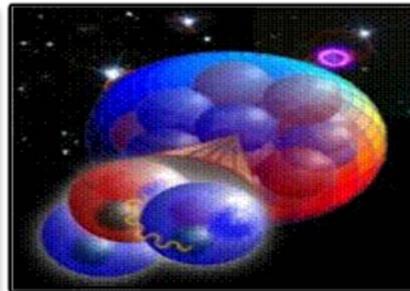
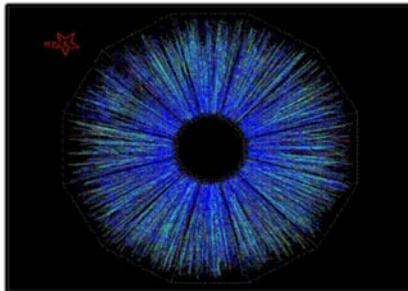
U.S. DEPARTMENT OF
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Office of
Science

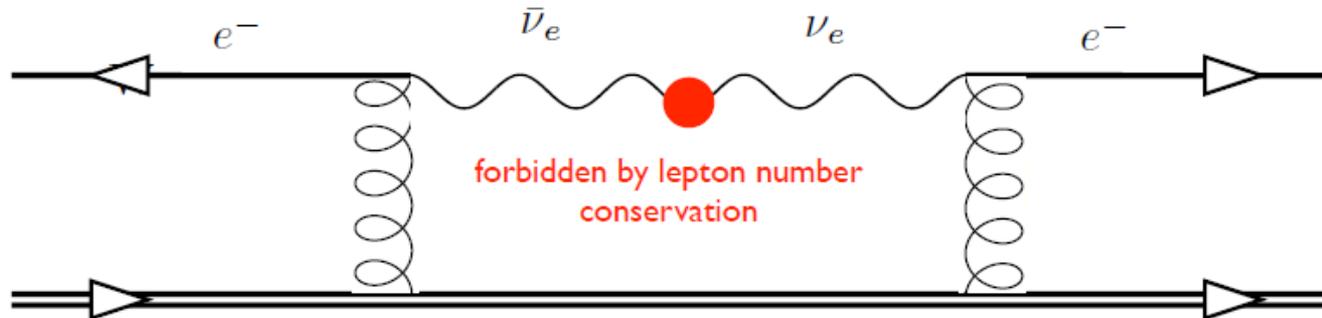
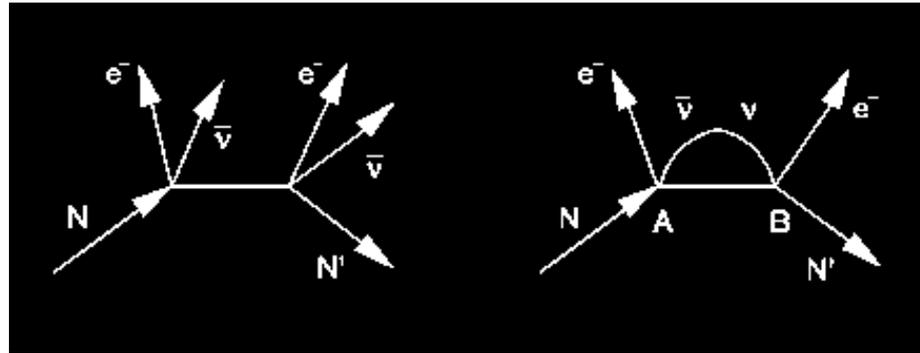
Charge to NSAC on Neutrino-less Double Beta Decay

Nuclear Science Advisory Committee Meeting
December 19, 2013

Dr. T. J. Hallman
Associate Director for Nuclear Physics
DOE Office of Science



The Importance and the Challenge of Neutrino-less Double Beta Decay



The primary motivation for double beta decay is to search for the violation of lepton number

If observed, this violation is likely to be associated with Majorana masses: a mass mechanism, unlike the Higgs mechanism, that reaches far outside our standard model, very possibly to the GUT scale

Recent and potential neutrino discoveries give important guidance. Much of the remaining possible “phase space” can be probed

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Within the Office of Science, it is agreed that NP will be the steward of a “tonne-scale” neutrino-less double beta decay experiment. HEP and NP will partner in supporting related research groups although details are yet to be finalized.

Through the R&D phase, demonstration experiments will be supported from their existing or traditional SC program offices

The exercise devoted to determining the approach/technology which offers the best overall scientific value will be inclusive of all efforts **without bias**.

As a first step to providing a foundation for this scientific vision, an NSAC subpanel with representation from both HEP and NP is being asked for an assessment of current status. This charge is timely as many first phase efforts have or will deliver results in the foreseeable future

As a precursor to developing an NSAC charge, discussions were held with HEP on the most efficient approach to this process. It was concluded that charging NSAC would be an appropriate and effective way to address this challenge

The NSAC Chair consulted with the HEPAP Chair concerning the makeup of the neutrino-less double beta decay subpanel.

Charge to NSAC on Neutrino-less Double Beta Decay



U.S. Department of Energy
and the
National Science Foundation



December 5, 2013

Dr. Donald Geesaman
Chair, DOE/NSF Nuclear Science Advisory Committee
Argonne National Laboratory
9800 South Cass Avenue
Argonne, Illinois 60439

Dear Dr. Geesaman:

This letter is to request that the DOE/NSF Nuclear Science Advisory Committee (NSAC) form a Subcommittee to provide guidance to the DOE and NSF regarding an effective strategy for implementing a possible second generation U.S. experiment on neutrino-less double beta decay (NLDBD) capable of reaching the sensitivity necessary to determine whether the nature of the neutrino is Majorana or Dirac. While the Office of Nuclear Physics is the Office of Science steward for NLDBD, this scientific question is of broad interest to both the Nuclear Science and High Energy Physics communities, and NSAC should solicit input from the High Energy Physics Advisory Panel (HEPAP) as well as the nuclear science community in formulating the membership of this Subcommittee.



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As you may know, in 2005 the Neutrino Scientific Assessment Group (NuSAG) jointly established by NSAC and HEPAP provided recommendations for a phased program of sensitive searches for NLDBD. Specifically, it recommended that:

“...the highest priority for the first phase of a neutrino-less double beta decay program is to support research in two or more neutrino-less double beta decay experiments to explore the region of degenerate neutrino masses ($m_{\beta\beta} > 100 \text{ meV}$). The knowledge gained and the technology developed in the first phase should then be used in a second phase to extend the exploration into the inverted hierarchy region of neutrino masses ($m_{\beta\beta} > 10\text{--}20 \text{ meV}$) with a single experiment.”

Consistent with this recommendation, a number of first-phase experiments exploring complementary approaches were undertaken with support from the DOE Nuclear Physics and High Energy Physics Offices and the NSF Particle Astrophysics Program. Early results from these experiments are or will be available in the foreseeable future.



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The NSAC Subcommittee is requested, in the context of ongoing and planned U.S. efforts as well as international competitiveness, to assess:

- The scientific merit of pursuing a second-generation NLDBD experiment;
- The status of ongoing and planned first phase NLDBD experiments toward achieving their goals, including major remaining challenges;
- The science-driven down-select criteria for arriving at the most promising approach to a second generation experiment, including a sensitivity goal that, at a high level of confidence, based on present understanding, would be expected to answer the question of the Majorana vs. Dirac nature of neutrinos for the inverted mass hierarchy scenario when combined with the results from other experiments that aim at establishing the hierarchy and masses of the three known neutrino flavors.
- Status and expected progress in theoretical calculations that are needed to determine the sensitivity limits that can ultimately be reached in NLDBD experiments.



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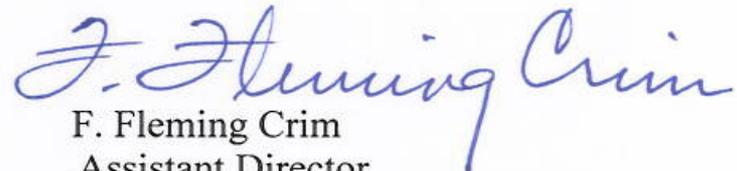
We expect that this panel will be a standing Subcommittee of NSAC, constituted for an initial period of two years and request that the Subcommittee submit its first report to the Office of Science and NSF by the end of April 2014. Subsequent reports to assess annual progress and the most promising candidate approaches capable of achieving necessary down select criteria should follow.

We are aware that this charge represents an additional burden on your time. However, the involvement of the research community is essential to inform the Agencies' decisions regarding investments in this potentially transformative scientific endeavor.

Sincerely,



Patricia M. Dehmer
Acting Director
Office of Science



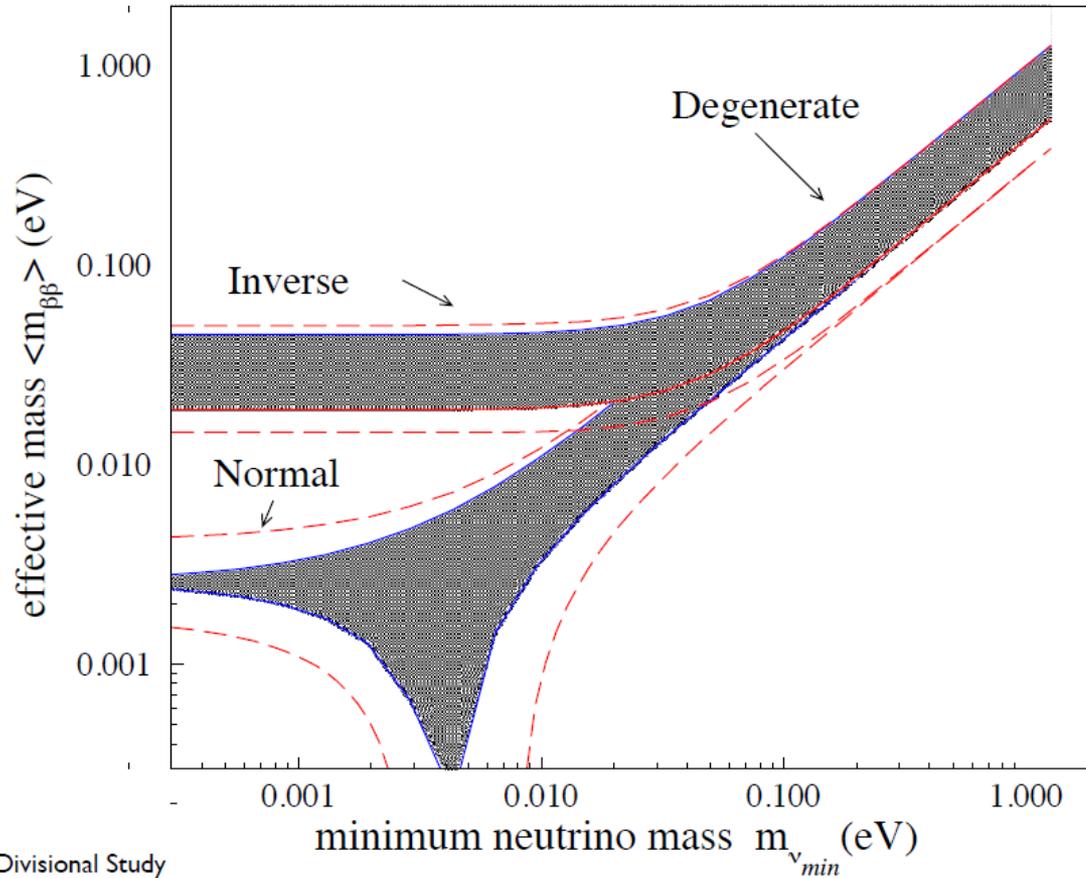
F. Fleming Crim
Assistant Director
Directorate for Mathematical
and Physical Sciences

cc: Professor Andrew Lankford
Chair, DOE/NSF HEPAP

Work on this charge by an NSAC subpanel will commence February, 2014



Additional Information



APS Multi-Divisional Study



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